

CLAIMS

What is claimed is:

1. A method of fabricating lead-free solder bumps, comprising:
providing a wafer having a protective layer with an open electrode pad;
forming an UBM (under bump metallization) layer on the wafer;
lithographing a photoresist on the UBM layer, excluding a portion of the UBM layer corresponding to the electrode pad;
forming a copper layer on the portion of the UBM layer corresponding to the electrode pad;
plating solder on the copper layer;
removing the photoresist; and
etching the UBM layer using the solder as a mask, and reflowing the solder and fabricating the solder bumps.
2. The method of fabricating lead-free solder bumps according to claim 1, wherein the solder comprises tin.
3. The method of fabricating lead-free solder bumps according to claim 2, wherein the solder further comprises silver.
4. The method of fabricating lead-free solder bumps according to claim 1, wherein the reflowing is performed for about 1 minute to about 20 minutes at a temperature of about 230° to about 270°C.
5. The method of fabricating lead-free solder bumps according to claim 1, wherein the copper layer has a thickness ranging from about 5 μm to about 20 μm .
6. The method of fabricating lead-free solder bumps according to claim 1, wherein the UBM layer comprises a first layer applied to the wafer, having one of titanium (Ti), tungsten (W), chrome (Cr), and titanium/tungsten (TiW), and a second layer applied to the first layer, having one of copper (Cu), nickel (Ni), a nickel/vanadium (Ni-V) alloy, and a copper/nickel (Cu-Ni) alloy.

7. A lead-free solder bump of a semiconductor wafer, comprising:
a semiconductor wafer;
an electrode pad formed on the semiconductor wafer;
a protective layer formed on the semiconductor wafer around the electrode pad;
an under bump metallization layer (UBM) formed on the electrode pad and the protective layer;
a copper layer formed on the UBM layer corresponding to the electrode pad; and
solder plated on the copper layer,
wherein UBM layer was etched using the solder as a mask, and the solder was reflowed to form a solder bump.

8. The solder bump of claim 7, wherein the UBM layer prevents diffusion between the electrode pad and the solder when the solder was reflowed, provides an electric path connecting all areas of the semiconductor wafer, and increases interface cohesion between the electrode pad and the solder bump.

9. The solder bump of claim 7, wherein the solder bump is a tin-copper binary solder bump formed by copper in the copper layer diffusing into the solder when the solder is reflowed.

10. The solder bump of claim 7, wherein the solder comprises tin.

11. The solder bump of claim 10, further comprising a copper-tin metal compound layer at an interface of the solder and the copper layer, formed by, when a temperature of the reflow of the solder is greater than a fusing point of the tin, a predetermined amount of copper in the copper layer diffusing into the solder and, simultaneously, the tin of the solder diffusing into the copper layer.

12. The solder bump of claim 10, wherein the solder further comprises silver, with the tin being the principal element in the solder, forming a tin-silver binary lead-free alloy.

13. The solder bump of claim 9, wherein a diffusion amount of the copper to the solder is controlled by adjusting a temperature and an amount of time of the reflow of the solder.

14. The method of fabricating lead-free solder bumps according to claim 1, wherein said reflowing the solder is performed before said etching the UBM layer.

15. The method of fabricating lead-free solder bumps according to claim 1, wherein said reflowing the solder is performed after said etching the UBM layer.

16. A method of fabricating lead-free solder bumps on a wafer having an electrode pad, comprising:

- forming an UBM (under bump metallization) layer on the wafer;
- forming a copper layer on the portion of the UBM layer corresponding to the electrode pad and plating solder on the copper layer; and
- reflowing the solder to form the solder bumps.

17. The method of fabricating lead-free solder bumps according to claim 16, further comprising:

- lithographing a photoresist on the UBM layer, excluding a portion of the UBM layer corresponding to the electrode pad, after said forming an UBM layer on the wafer;
- removing the photoresist after said plating solder on the copper layer; and
- etching the UBM layer using the solder as a mask after said removing the photoresist.

18. The method of fabricating lead-free solder bumps according to claim 16, further comprising:

- lithographing a photoresist on the UBM layer, excluding a portion of the UBM layer corresponding to the electrode pad, after said forming an UBM layer on the wafer;
- removing the photoresist after said plating solder on the copper layer; and
- etching the UBM layer using the solder as a mask after said reflowing the solder to form the solder bumps.